analyzing and dispersing the radiation modified by and collected from the sample to provide a polarimetric spectrum, wherein no substantial relative change in polarization state between the radiation and the sample beam is caused by relative motion between optical elements employed in the focusing, collecting and analyzing; and

deriving information on optically detectable properties of the sample from said polarimetric spectrum.

2 ~~90~~. The method of claim 1 ~~89~~, further comprising splitting a beam of broadband radiation into said polarized sample beam and a reference beam; wherein said focusing focuses said sample beam onto the sample.

3 ~~91~~. The method of claim 2 ~~90~~, further comprising detecting the reference beam to provide a reference spectrum; and wherein said deriving comprises comparing said polarimetric spectrum and said reference spectrum to obtain said information of the sample.

91 Cont

4 ~~92~~. The method of claim 3 ~~91~~, said beam and said reflected and reference spectra comprising multiple wavelengths in a range from about 190 nm to about 830 nm.

5 ~~93~~. The method of claim 2 ~~90~~, said splitting comprising directing the beam to a mirror placed less than completely across said radiation beam.

6 ~~94~~. The method of claim 2 ~~90~~, said splitting comprising deflecting a portion of said beam into a sample beam, the undeflected portion of the radiation defining a reference radiation beam.

7 ~~95~~. The method of claim 1 ~~89~~, further comprising passing a beam of radiation through a polarizer to obtain the sample beam, wherein said analyzing analyzes by means of an

LAW OFFICES OF
SKJERVEN MORRILL LLP
3 EMBARCADERO CENTER
SUITE 2800
SAN FRANCISCO, CA 94111
(415) 217-6000
FAX (415) 434-0646

24

a

analyzer, and wherein during the focusing and analyzing, the polarizer and analyzer do not rotate.

8 ~~96~~. The method of claim 1 ~~89~~, further comprising polarizing a beam of broadband radiation to provide said polarized beam, wherein said focusing focuses said polarized beam such that a beam having a multitude of polarization states is focused onto the sample, wherein said polarization states are functions of an angle φ to a reference plane normal to a sample surface, said angle φ having a range defining a substantial angle of an illumination aperture.

9 ~~97~~. The method of claim 8 ~~96~~, wherein said focusing focuses said polarized beam along different planes of incidence onto the sample, said planes being at different angles φ to the reference plane, the range of said angle of the illumination aperture being about 90 or 180 degrees.

10 ~~98~~. The method of claim 1 ~~89~~, wherein said focusing and collecting employ a common objective.

a1 Cont

11 ~~99~~. The method of claim 1 ~~89~~, said sample having different optically detectable properties along at least two axes, wherein said focusing or collecting employs an aperture centered about one of said axes.

12 ~~100~~. The method of claim 11 ~~99~~, wherein said focusing and collecting are repeated employing at least two different apertures aligned respectively about at least two of said axes.

13 ~~101~~. The method of claim 12 ~~100~~, wherein said focusing and collecting are repeated employing at least two different apertures centered respectively about at least two of said axes.

LAW OFFICES OF
SKJERVEN MORRILL LLP
3 EMBARCADERO CENTER
SUITE 2800
SAN FRANCISCO, CA 94111
(415) 217-6000
FAX (415) 434-0646

14 ~~102~~. The method of claim ~~89~~ 1, wherein said focusing and collecting are repeated employing two different apertures to detect presence or absence of a difference in optically detectable properties along at least two axes of the sample.

15 ~~103~~. The method of claim ~~89~~ 1, said polarimetric spectrum comprising multiple wavelengths in a range from about 190 nm to about 830 nm.

16 ~~104~~. The method of claim ~~89~~ 1, wherein said analyzing analyzes the radiation modified by the sample with respect to a predetermined and fixed polarization plane.

17 ~~105~~. The method of claim ~~89~~ 1, further comprising altering phase of the radiation modified by and collected from the sample prior to analyzing and dispersing it.

18 ~~106~~. The method of claim ~~105~~ 17, wherein said altering retards said phase of the modified and collected radiation by about $\pi/4$ radians.

19 ~~107~~. The method of claim ~~89~~ 1, wherein said focusing focuses said sample beam so that it surrounds a line normal to a surface of the sample.

a1 cont

20 ~~108~~. The method of claim ~~89~~ 1, the radiation in said beam comprising at least one ultraviolet or deep ultraviolet wavelength.

21 ~~109~~. The method of claim ~~89~~ 1, further comprising:

providing a reference beam;

detecting the reference beam to provide a reference spectrum; and

wherein said deriving comprises comparing said spectrum and said reference spectrum to obtain said information of the sample.

LAW OFFICES OF
SKJERVEN MORRILL LLP
3 EMBARCADERO CENTER
SUITE 2800
SAN FRANCISCO, CA 94111
(415) 217-6000
FAX (415) 434-0646

22 ~~110~~. The method of claim ~~89~~ 1, said focusing or collecting being performed at least twice and within at least two different ranges of angles to a reference plane normal to a sample surface.

23 ~~111~~. The method of claim ~~110~~ 22, said sample having different optically detectable properties along at least two axes, wherein said focusing or collecting are repeated employing at least two different apertures each aligned or centered respectively about one of said axes.

24 ~~112~~. The method of claim ~~111~~ 23, wherein said at least two different apertures are substantially 90 degrees apart.

25 ~~113~~. The method of claim ~~89~~ 1, wherein said focusing, collecting, dispersing and deriving are performed twice, once with polarization states of the sample beam and/or those of the modified and collected radiation within a first range of angles to a reference plane normal to a sample surface, and another time with said polarization states within a second different range of angles to the reference plane.

a1 cont

26 ~~114~~. The method of claim ~~113~~ 25, further comprising polarizing the sample beam before it reaches the sample, and/or analyzing the radiation modified by and collected from the sample with a polarizing element so that radiation of the sample beam and/or the modified and collected radiation is polarized, with the polarizing element in two different positions when the focusing, collecting, dispersing and deriving are performed twice.

27 ~~115~~. The method of claim ~~114~~ 26, wherein said two different positions are substantially 90 degrees apart by rotation.

28 ~~116~~. An apparatus for measuring optically detectable properties of a sample, comprising:

LAW OFFICES OF
SKJERVEN MORRILL LLP
3 EMBARCADERO CENTER
SUITE 2800
SAN FRANCISCO, CA 94111
(415) 217-6000
FAX (415) 434-0646

21

a

first optics focusing a polarized sample beam of broadband radiation onto the surface of the sample, the sample beam having a multitude of polarization states, wherein said sampling beam is focused along directions substantially surrounding a line normal to said sample;

second optics collecting radiation modified by the sample, said second optics comprising an objective; and

an instrument analyzing and dispersing the radiation modified by and collected from the sample to provide a polarimetric spectrum, wherein no substantial relative change in polarization state between the radiation and the sample beam is caused by relative motion between the first and second optics and the instrument;

wherein said information on optically detectable properties of the sample is derivable from said polarimetric spectrum.

29 ~~117~~. The apparatus of claim 28 ~~116~~, further comprising:

a radiation source providing a beam of broadband radiation; and

third optics splitting said beam of broadband radiation into said polarized sample beam and said reference beam, wherein said first optics focuses said sample beam onto the sample so that the focused beam has a multitude of polarization states, wherein said polarization states are functions of an angle φ to a reference plane normal to a sample surface, said angle φ having a range defining a substantial angle of an illumination aperture.

30 ~~118~~. The apparatus of claim 29 ~~117~~, wherein said first optics focuses said polarized beam along different planes of incidence onto the sample, said planes being at different angles

LAW OFFICES OF
SKJERVEN MORRILL LLP
3 EMBARCADERO CENTER
SUITE 2800
SAN FRANCISCO, CA 94111
(415) 217-6000
FAX (415) 434-0646

.phi. to the reference plane, said angle of the illumination aperture being about 90 or 180 degrees.

31 ~~119~~. The apparatus of claim 29 ~~117~~, said third optics comprising a totally reflecting mirror placed less than completely across said beam.

32 ~~120~~. The apparatus of claim 29 ~~117~~, said third optics deflecting a portion of said radiation in the beam from the source into a sample beam, the undeflected portion of the radiation defining a reference radiation beam.

33 ~~121~~. The apparatus of claim 29 ~~117~~, wherein information on optically detectable properties of the sample is derivable from a comparison of said polarimetric spectrum and said reference spectrum.

34 ~~122~~. The apparatus of claim 33 ~~121~~, said radiation beam and said polarimetric and reference spectra comprising multiple wavelengths in a range from about 190 nm to about 830 nm.

91 Cont

35 ~~123~~. The apparatus of claim 29 ~~117~~, wherein said third optics comprises a polarizing beam splitter.

36 ~~124~~. The apparatus of claim 29 ~~117~~, wherein said third optics comprise a beam divider, said apparatus further comprising a polarizer.

37 ~~125~~. The apparatus of claim 36 ~~124~~, said polarizer being in an optical path to the first optics and forms a part of the instrument.

38 ~~126~~. The apparatus of claim 36 ~~124~~, said polarizer being in an optical path to the first optics, said instrument comprising an analyzer in an optical path from the second optics.

LAW OFFICES OF
SKJERVEN MORRILL LLP
3 EMBARCADERO CENTER
SUITE 2800
SAN FRANCISCO, CA 94111
(415) 217-6000
FAX (415) 434-0646

a

34 ~~127~~. The apparatus of claim 28 ~~116~~, said instrument comprising an analyzer, said apparatus further comprising a polarizer passing a beam of broadband radiation to form said polarized sample beam, wherein during the focusing by the first optics and analyzing by the instrument, the polarizer and analyzer do not rotate.

40 ~~128~~. The apparatus of claim 28 ~~116~~, wherein said first and second optics comprise a common objective that focuses the sample beam onto and collects radiation modified by the sample.

41 ~~129~~. The apparatus of claim 28 ~~116~~, further comprising a flip-in polarizer and a device moving the polarizer into and out of a path of the beam of broadband radiation from a radiation source to provide the sample beam that is polarized or unpolarized.

42 ~~130~~. The apparatus of claim 41 ~~129~~, wherein said polarizer polarizes the beam originating from the source and analyses the radiation modified by and collected from the sample.

a1 Cont

43 ~~131~~. The apparatus of claim 28 ~~116~~, further comprising a source of radiation, wherein said first optics focuses radiation from the source onto the sample, said sample having different optically detectable properties along at least two axes, said apparatus further comprising at least one aperture aligned with one of said axes, said aperture being in an optical path between the source and the instrument.

44 ~~132~~. The apparatus of claim 43 ~~131~~, wherein said at least one aperture is centered about said one of the axes.

45 ~~133~~. The apparatus of claim 43 ~~131~~, further comprising a mechanism selecting one of at least two apertures to be aligned with one of the axes.

LAW OFFICES OF
SKJERVEN MORRILL LLP

3 EMBARCADERO CENTER
SUITE 2800
SAN FRANCISCO, CA 94111
(415) 217-6000
FAX (415) 434-0646

a

46 ~~134~~. The apparatus of claim ~~133~~ 45, wherein said mechanism causes each of two different apertures to be aligned with a corresponding one of the axes, so that the polarimetric spectra obtained when the two apertures are aligned consecutively with their corresponding axes yields information on optically detectable properties of the sample.

47 ~~135~~. The apparatus of claim ~~134~~ 46, wherein said mechanism comprise a wheel with at least two apertures therein.

48 ~~136~~. The apparatus of claim ~~135~~ 47, wherein said wheel comprise a polarizer in each of the at least two apertures.

49 ~~137~~. The apparatus of claim ~~135~~ 47, wherein two of said at least two apertures have shapes substantially in the shape of a circle with one quadrant blocked.

50 ~~138~~. The apparatus of claim ~~116~~ 28, further comprising a source of radiation, wherein said first optics focuses radiation from the source onto the sample, said sample having different optically detectable properties along at least two axes, said apparatus further comprising a mechanism rotating a linear polarizer in an optical path of the sample beam for detecting said axes.

a1 cont

51 ~~139~~. The apparatus of claim ~~116~~ 28, said broadband radiation comprising multiple wavelengths in a range from about 190 nm to about 830 nm.

52 ~~140~~. The apparatus of claim ~~116~~ 28, wherein said instrument analyzes the radiation modified by the sample with respect to a predetermined and fixed polarization plane.

53 ~~141~~. The apparatus of claim ~~116~~ 28, further comprising a phase retarder in an optical path between the second optics and the instrument, said retarder altering phase of the modified radiation collected from the sample prior to analyzing and dispersing it.

LAW OFFICES OF
SKJERVEN MORRILL LLP
3 EMBARCADERO CENTER
SUITE 2800
SAN FRANCISCO, CA 94111
(415) 217-6000
FAX (415) 434-0646

a

53

54 ~~142~~. The apparatus of claim ~~141~~, wherein said retarder retards said phase of the modified and collected radiation by about $\pi/4$ radians.

28

55 ~~143~~. The apparatus of claim ~~116~~, said first or second optics comprising a mirror having a coating that introduces a total change in phase of radiation reflected by it by the first and second optics of about $\pi/2$ radians.

56 28

~~144~~. The apparatus of claim ~~116~~, wherein said sample beam surrounds a line normal to a surface of the sample.

57 28

~~145~~. The apparatus of claim ~~116~~, further comprising a common polarizing element that polarizes a sample beam before it is focused by the first optics, and that analyzes the radiation modified by and collected from the sample.

58 57

~~146~~. The apparatus of claim ~~145~~, wherein said common polarizing element comprises a polarizer or a polarizing beam splitter.

59 28

~~147~~. The apparatus of claim ~~116~~, further comprising a xenon and/or deuterium lamp supplying radiation.

60 28

~~148~~. The apparatus of claim ~~116~~, wherein said focusing, collecting and dispersing are performed twice, once with polarization states of the sample beam and/or those of the modified and collected radiation within a first range of angles to a reference plane normal to a sample surface, and another time with said polarization states within a second different range of angles to the reference plane.

61 28

~~149~~. The apparatus of claim ~~116~~, further comprising a polarizing element polarizing the sample beam before it reaches the sample, and/or analyzing the radiation modified by and collected from the sample to polarize the sample beam and/or the modified and collected

a) cont

LAW OFFICES OF
SKJERVEN MORRILL LLP
3 EMBARCADERO CENTER
SUITE 2800
SAN FRANCISCO, CA 94111
(415) 217-6000
FAX (415) 434-0646

radiation, and an instrument moving the element between at least two different positions where the focusing, collecting and dispersing are performed.

62 ~~150~~. The apparatus of claim ~~149~~ 61, wherein said two different positions are substantially 90 degrees apart by rotation.

63 ~~151~~. A method for obtaining information of one or more layers of a sample, said method comprising:

focusing a polarized first sample beam of broadband radiation onto the one or more layers, said beam having a multitude of polarization states;

collecting radiation that originates from the first beam and that is modified by the one or more layers of the sample by means of an objective;

analyzing and dispersing the radiation modified and collected from the sample to provide a polarimetric spectrum;

focusing a polarized second beam of radiation at said one or more layers in a direction at an oblique angle to the one or more layers;

a1 cont

obtaining measurements of changes in polarization state in amplitude and phase of the radiation that has been modified by the one or more layers and that originates from the second beam; and

determining information on optically detectable properties of said one or more layers from said measurements and the polarimetric spectrum.

64 ~~152~~. The method of claim ~~151~~ 63, wherein said first and second beams of radiation are focused to substantially the same area of said one or more layers.

LAW OFFICES OF
SKJERVEN MORRILL LLP
3 EMBARCADERO CENTER
SUITE 2800
SAN FRANCISCO, CA 94111
(415) 217-6000
FAX (415) 434-0646

a

65 ~~153.~~ The method of claim ~~151~~ 63, wherein said first and second beams of radiation are focused to the one or more layers substantially simultaneously, and said collecting, analyzing and obtaining are performed substantially simultaneously.

66 ~~154.~~ The method of claim ~~151~~ 63, further comprising splitting a beam of broadband radiation into said first beam and a reference beam; wherein said first beam focusing focuses said first beam onto the one or more layers.

67 ~~155.~~ The method of claim ~~154~~ 66, further comprising detecting the reference beam to provide a reference spectrum; and wherein said determining comprises comparing said polarimetric spectrum and said reference spectrum.

68 ~~156.~~ The method of claim ~~154~~ 66, said splitting comprising directing the beam of broadband radiation to a mirror placed less than completely across said radiation beam.

69 ~~157.~~ The method of claim ~~154~~ 66, said splitting comprising deflecting a portion of said beam of broadband radiation into a sample beam, the undeflected portion of the radiation defining a reference radiation beam.

a1 cont

70 ~~158.~~ The method of claim ~~151~~ 63, further comprising polarizing a beam of broadband radiation to provide a polarized beam, wherein said focusing focuses such polarized beam such that the first polarized sample beam having a multitude of polarization states is focused onto the sample.

71 ~~159.~~ The method of claim ~~158~~ 70, wherein said focusing focuses said polarized beam along different planes of incidence onto the sample.

72 ~~160.~~ The method of claim ~~151~~ 63, wherein said first beam focusing and collecting employ a common objective.

LAW OFFICES OF
SKJERVEN MORRILL LLP
3 EMBARCADERO CENTER
SUITE 2800
SAN FRANCISCO, CA 94111
(415) 217-6000
FAX (415) 434-0646

73 ~~161~~. The method of claim ~~151~~ 63, said polarimetric spectrum comprising multiple wavelengths in a range from about 190 nm to about 830 nm.

74 ~~162~~. The method of claim ~~151~~ 63, wherein said analyzing and dispersing analyze the radiation modified by the sample with respect to a predetermined and fixed polarization plane.

75 ~~163~~. The method of claim ~~151~~ 63, wherein the second beam focusing focuses a polarized second laser beam at said one or more layers, said obtaining obtains measurements of changes in polarization state caused by the one or more layers at the wavelength of the laser, and said determining determines the refractive indices of the one or more layers over said polarimetric spectrum.

76 ~~164~~. The method of claim ~~151~~ 63, wherein the second beam focusing focuses a polarized second beam of broadband radiation at said one or more layers, said obtaining obtains measurements of changes in polarization state caused by the one or more layers over a spectrum of the second beam, and said determining determines the refractive indices of the one or more layers over a combined spectrum of the first and second beams.

91 Cont

77 ~~165~~. The method of claim ~~164~~ 76, said combined spectrum comprising multiple wavelengths in a range from about 190 nm to about 830 nm.

78 ~~166~~. The method of claim ~~151~~ 63, further comprising altering phase of the radiation modified by and collected from the sample prior to analyzing and dispersing it.

79 ~~167~~. The method of claim ~~166~~ 78, wherein said altering retards said phase of the modified and collected radiation by about $\pi/4$ radians.

80 ~~168~~. An apparatus for obtaining information of one or more layers of a sample, said apparatus comprising:

LAW OFFICES OF
SKJERVEN MORRILL LLP
3 EMBARCADERO CENTER
SUITE 2800
SAN FRANCISCO, CA 94111
(415) 217-6000
FAX (415) 434-0646

a

first optics focusing a first polarized sample beam of broadband radiation to the one or more layers, and a second sample beam of polarized radiation at said one or more layers in a direction at an oblique angle to the one or more layers;

second optics collecting radiation that originates from the first beam and that is modified by the one or more layers of the sample, said second optics comprising an objective;

an instrument analyzing and dispersing the radiation modified and collected from the sample to provide a polarimetric spectrum; and

an ellipsometer obtaining measurements of changes in polarization state in amplitude and phase of the modified radiation from the one or more layers originating from second beam;

wherein information on optically detectable properties of said one or more layers is derivable from the measurements of the ellipsometer and the polarimetric spectrum.

81 ~~169~~. The apparatus of claim 80 ~~168~~, wherein said first optics focuses the first and second beams of radiation to substantially the same area of said one or more layers.

a, cont

82 ~~170~~. The apparatus of claim 80 ~~168~~, wherein said instrument comprises a spectrometer.

83 ~~171~~. The apparatus of claim 80 ~~168~~, wherein said first optics focuses the first and second beams of radiation to the one or more layers substantially simultaneously, and said second optics, the instrument and the ellipsometer perform their respective functions substantially simultaneously.

LAW OFFICES OF
SKJERVEN MORRILL LLP
3 EMBARCADERO CENTER
SUITE 2800
SAN FRANCISCO, CA 94111
(415) 217-6000
FAX (415) 434-0646

84 ~~172~~. The apparatus of claim 80 ~~168~~, further comprising:

a radiation source providing a beam of broadband radiation; and

third optics splitting said beam of broadband radiation into said polarized first beam and a reference beam, wherein said first optics focuses said first beam onto the one or more layers of the sample so that the focused beam has a multitude of polarization states.

85 ~~173~~. The apparatus of claim 84 ~~172~~, wherein said third optics splits said beam from the source into a polarized sample beam and a polarized reference beam.

86 ~~174~~. The apparatus of claim 85 ~~173~~, said third optics comprising a totally reflecting mirror placed less than completely across said beam.

87 ~~175~~. The apparatus of claim 85 ~~173~~, said third optics deflecting a portion of said radiation in the beam from the source into a sample beam, the undeflected portion of the radiation defining a reference radiation beam.

88 ~~176~~. The apparatus of claim 85 173, wherein said third optics comprises a polarizing beam splitter.

89 ~~177~~. The apparatus of claim 85 ~~173~~, wherein said third optics comprises a beam divider, said apparatus further comprising a polarizer.

a1 Cont

90 ~~178~~. The apparatus of claim 89 ~~177~~, said polarizer being in an optical path to the first optics and forms a part of the instrument.

91 ~~179~~. The apparatus of claim 89 ~~177~~, said polarizer being in an optical path to the first optics, said instrument comprising an analyzer in an optical path from the second optics.

92 ~~180~~. The apparatus of claim 80 ~~168~~, further comprising a detector detecting the reference beam to provide a reference spectrum, wherein said information is derivable by comparing said polarimetric spectrum and said reference spectrum.

LAW OFFICES OF
SKJERVEN MORRILL LLP
3 EMBARCADERO CENTER
SUITE 2800
SAN FRANCISCO, CA 94111
(415) 217-6000
FAX (415) 434-0646

93 ~~181~~. The apparatus of claim ~~180~~ 92, said polarimetric and reference spectra comprising multiple wavelengths in a range from about 190 nm to about 830 nm.

94 ~~182~~. The apparatus of claim ~~168~~ 80, said instrument comprising an analyzer, said apparatus further comprising a polarizer polarizing a beam of broadband radiation to generate the first polarized sample beam, wherein said analyzer and the polarizer do not rotate when radiation from the first and second beams is modified by the sample and collected, dispersed, analyzed and measured.

95 ~~183~~. The apparatus of claim ~~168~~ 80, wherein said first optics focuses said polarized beam along different planes of incidence onto the sample.

96 ~~184~~. The apparatus of claim ~~168~~ 80, wherein said first and second optics comprise a common objective that focuses the first beam onto and collects radiation modified by the one or more layers at the surface of the sample.

97 ~~185~~. The apparatus of claim ~~168~~ 80, further comprising a flip-in polarizer and a mechanism moving the polarizer into and out of a path of a beam of broadband radiation from a radiation source to provide the first sample beam that is focused by the first optics.

91 Cont

98 ~~186~~. The apparatus of claim ~~185~~ 97, wherein said polarizer polarizes the beam originating from the source to provide the first sample beam and analyses the radiation that is modified by the sample and collected by the second optics and that originates from the first beam.

99 ~~187~~. The apparatus of claim ~~168~~ 80, said broadband radiation of the first and second beams comprising multiple wavelengths in a range from about 190 nm to about 830 nm.

LAW OFFICES OF
SKJERVEN MORRILL LLP
3 EMBARCADERO CENTER
SUITE 2800
SAN FRANCISCO, CA 94111
(415) 217-6000
FAX (415) 434-0646

a

100 ~~188~~. The apparatus of claim ~~168~~ 80, wherein said instrument analyzes the radiation modified by the surface of the sample and from the first sample beam with respect to a predetermined and fixed polarization plane.

101 ~~189~~. The apparatus of claim ~~168~~ 80, wherein said second beam is a laser beam whose wavelength is in the polarimetric spectrum, wherein the ellipsometer is a single wavelength ellipsometer that obtains measurements of changes in polarization state caused by the one or more layers at the wavelength of the laser, and wherein thickness information and refractive indices of the one or more layers are derivable over said polarimetric spectrum.

102 ~~190~~. The apparatus of claim ~~168~~ 80, said second beam having wavelengths in a broadband, wherein the ellipsometer is a spectroscopic ellipsometer that obtains measurements of changes in polarization state caused by the one or more layers over the spectrum of the second beam, and said determining determines the refractive indices of the one or more layers over a combined spectrum of the first and second beams.

103 ~~191~~. The method of claim ~~190~~ 102, said combined spectrum comprising multiple wavelengths ranging from about 190 nm to about 830 nm.

a1 Cont

104 ~~192~~. The apparatus of claim ~~168~~ 80, said first or second optics comprising a mirror having a coating that introduces a total change in phase of radiation reflected by it by the first and second optics of about $\pi/2$ radians.

105 ~~193~~. A method for measuring optically detectable properties of a sample, comprising:

focusing a sample beam of radiation onto the sample, the radiation in said beam comprising at least one ultraviolet or deep ultraviolet wavelength;

collecting radiation modified by the sample;

LAW OFFICES OF
SKJERVEN MORRILL LLP
3 EMBARCADERO CENTER
SUITE 2800
SAN FRANCISCO, CA 94111
(415) 217-6000
FAX (415) 434-0646

dispersing the radiation modified by and collected from the sample to provide a spectrum, wherein no substantial relative change in polarization state between the radiation and the sample beam is caused by relative motion between optical elements employed in the focusing and collecting, wherein the radiation in the sample beam and/or the dispersed radiation is polarized; and

deriving information on optically detectable properties of the sample from said spectrum.

106 ~~194.~~ The method of claim 105 ~~193~~, further comprising:

providing a reference beam;

detecting the reference beam to provide a reference spectrum; and

wherein said deriving comprises comparing said spectrum and said reference spectrum to obtain said information of the sample.

a) Cont

107 ~~195.~~ The method of claim 105 ~~193~~, wherein radiation in the sample beam and/or radiation that is dispersed is polarized.

108 ~~196.~~ The method of claim 105 ~~195~~, further comprising polarizing the sample beam before it reaches the sample, and analyzing the radiation modified by and collected from the sample, by a common polarizing element.

109 ~~197.~~ The method of claim 108 ~~196~~, wherein said polarizing and analyzing are performed by means of a polarizer or a polarizing beam splitter.

110 ~~198.~~ The method of claim 105 ~~193~~, further comprising polarizing a beam of broadband radiation to provide said sample beam, wherein said focusing focuses said polarized sample

LAW OFFICES OF
SKJERVEN MORRILL LLP

3 EMBARCADERO CENTER
SUITE 2800
SAN FRANCISCO, CA 94111
(415) 217-6000
FAX (415) 434-0646

beam such that a beam having a multitude of polarization states is focused onto the sample, wherein said polarization states are functions of an angle φ to a reference plane normal to a sample surface, said angle φ having a range defining a substantial angle of an illumination aperture.

111 ~~199~~. The method of claim 110 ~~198~~, wherein said focusing focuses said polarized beam along different planes of incidence onto the sample, said planes being at different angles φ to the reference plane, the range of said angle of the illumination aperture being about 90 or 180 degrees.

112 ~~200~~. The method of claim 105 ~~193~~, said focusing or collecting being performed at least twice and within at least two different ranges of angles to a reference plane normal to a sample surface.

113 ~~201~~. The method of claim 112 ~~200~~, said sample having different optically detectable properties along at least two axes, wherein said focusing or collecting are repeated employing at least two different apertures each aligned or centered respectively about one of said axes.

91 Cont

114 ~~202~~. The method of claim 113 ~~201~~, wherein said at least two different apertures are substantially 90 degrees apart.

115 ~~203~~. The method of claim 105 ~~193~~, wherein said focusing, collecting, dispersing and deriving are performed twice, once with polarization states of the sample beam and/or those of the modified and collected radiation within a first range of angles to a reference plane normal to a sample surface, and another time with said polarization states within a second different range of angles to the reference plane.

LAW OFFICES OF
SKJERVEN MORRILL LLP
3 EMBARCADERO CENTER
SUITE 2800
SAN FRANCISCO, CA 94111
(415) 217-6000
FAX (415) 434-0646

41

a

116 ~~204~~. The method of claim 115 ~~203~~, further comprising polarizing the sample beam before it reaches the sample, and/or analyzing the radiation modified by and collected from the sample with a polarizing element so that radiation of the sample beam and/or the modified and collected radiation is polarized, with the polarizing element in two different positions when the focusing, collecting, dispersing and deriving are performed twice.

117 ~~205~~. The method of claim 116 ~~204~~, wherein said two different positions are substantially 90 degrees apart by rotation.

118 ~~206~~. A method for measuring optically detectable properties of a sample, comprising:

focusing a sample beam of radiation onto the sample;

collecting radiation modified by the sample;

dispersing the radiation modified by and collected from the sample to provide a spectrum, wherein no substantial relative change in polarization state between the radiation and the sample beam is caused by relative motion between optical elements employed in the focusing, collecting and analyzing;

a1 Cont

deriving information on optically detectable properties of the sample from said spectrum; and

polarizing the sample beam before it reaches the sample and/or analyzing the radiation modified by and collected from the sample, wherein said focusing, collecting, dispersing and deriving are performed twice, once with polarization states of the sample beam and/or those of the modified and collected radiation within a first range of angles to a reference plane normal to a sample surface, and another time with said polarization states within a second different range of angles to the reference plane.

LAW OFFICES OF
SKJERVEN MORRILL LLP
3 EMBARCADERO CENTER
SUITE 2800
SAN FRANCISCO, CA 94111
(415) 217-6000
FAX (415) 434-0646

119 ~~207~~. The method of claim ~~206~~ 118, wherein said polarizing and/or analyzing is performed with a polarizing element so that radiation of the sample beam and/or the modified and collected radiation is polarized, with the polarizing element in two different positions when the focusing, collecting dispersing and deriving are performed twice.

120 ~~208~~. The method of claim ~~207~~ 119, wherein said two different positions are substantially 90 degrees apart by rotation.

121 ~~209~~. The method of claim ~~207~~ 119, further comprising polarizing the sample beam before it reaches the sample, and analyzing the radiation modified by and collected from the sample, by a common polarizing element.

122 ~~210~~. The method of claim ~~209~~ 121, wherein said polarizing and analyzing are performed by means of a polarizer or a polarizing beam splitter.

123 ~~211~~. The method of claim ~~206~~ 118, wherein the polarizing polarizes a beam of broadband radiation to provide said sample beam, wherein said focusing focuses said polarized sample beam such that a beam having a multitude of polarization states is focused onto the sample, wherein said polarization states are functions of an angle φ to a reference plane normal to a sample surface, said angle φ having a range defining a substantial angle of an illumination aperture.

a1 Cont

124 ~~212~~. The method of claim ~~211~~ 123, wherein said focusing focuses said polarized sample beam along different planes of incidence onto the sample, said planes being at different angles φ to the reference plane, the range of said angle of the illumination aperture being about 90 or 180 degrees.

LAW OFFICES OF
SKJERVEN MORRILL LLP
3 EMBARCADERO CENTER
SUITE 2800
SAN FRANCISCO, CA 94111
(415) 217-6000
FAX (415) 434-0646

125 ~~213~~. The method of claim 118 ~~206,~~ the radiation in said sample beam comprising at least one ultraviolet or deep ultraviolet wavelength.

126 ~~214.~~ The method of claim 118 ~~206,~~ further comprising:

providing a reference beam;

detecting the reference beam to provide a reference spectrum; and

wherein said deriving comprises comparing said spectrum and said reference spectrum to obtain said information of the sample.

127 ~~215.~~ The method of claim 118 ~~206,~~ said focusing or collecting being performed twice and within two different ranges of angles to a reference plane normal to a sample surface.

128 ~~216.~~ The method of claim 127 ~~215~~, said sample having different optically detectable properties along at least two axes, wherein said focusing or collecting are performed twice employing at least two different apertures each aligned or centered respectively about one of said axes.

129 ~~217.~~ The method of claim 128 ~~216,~~ wherein said at least two different apertures are substantially 90 degrees apart.

a, Cont

130 ~~218.~~ A method for measuring optically detectable properties of a sample, comprising:

focusing a sample beam of radiation onto the sample;

collecting radiation modified by the sample;

dispersing the radiation modified by and collected from the sample to provide a spectrum, wherein no substantial relative change in polarization state between the radiation

LAW OFFICES OF
SKJERVEN MORRILL LLP
3 EMBARCADERO CENTER
SUITE 2800
SAN FRANCISCO, CA 94111
(415) 217-6000
FAX (415) 434-0646

and the sample beam is caused by relative motion between optical elements employed in the focusing, collecting and analyzing; and

deriving information on optically detectable properties of the sample from said spectrum;

said focusing or collecting being performed twice and within two different ranges of angles to a reference plane normal to a sample surface.

131 ~~219~~. The method of claim 130 ~~218~~, said sample having different optically detectable properties along at least two axes, wherein said focusing or collecting are performed twice employing at least two different apertures each aligned or centered respectively about one of said axes.

132 ~~220~~. The method of claim 131 ~~219~~, wherein said at least two different apertures are substantially 90 degrees apart.

133 ~~221~~. The method of claim 130 ~~218~~, further comprising polarizing the sample beam before it reaches the sample and/or analyzing the radiation modified by and collected from the sample, wherein said focusing, collecting and dispersing are performed twice, once with polarization states of the sample beam and/or those of the modified and collected radiation within a first range of angles to a reference plane normal to a sample surface, and another time with said polarization states within a second different range of angles to the reference plane.

a1 cont

134 ~~222~~. The method of claim 133 ~~221~~, wherein said polarizing is performed with a polarizing element so that radiation of the sample beam and/or the modified and collected

LAW OFFICES OF
SKJERVEN MORRILL LLP
3 EMBARCADERO CENTER
SUITE 2800
SAN FRANCISCO, CA 94111
(415) 217-6000
FAX (415) 434-0646

a

radiation is polarized, with the polarizing element in two different positions when the focusing, collecting and dispersing are performed twice.

135 ~~223~~. The method of claim 134 ~~222~~, wherein said two different positions are substantially 90 degrees apart by rotation.

136 ~~224~~. The method of claim 134 ~~222~~, wherein the radiation in the sample beam and/or the dispersed radiation is polarized.

137 ~~225~~. The method of claim 136 ~~224~~, further comprising polarizing the sample beam before it reaches the sample, and analyzing the radiation modified by and collected from the sample, by a common polarizing element.

138 ~~226~~. The method of claim 137 ~~225~~, wherein said polarizing and analyzing are performed by means of a polarizer or a polarizing beam splitter.

139 ~~227~~. The method of claim 130 ~~218~~, further comprising polarizing a beam of broadband radiation to provide said sample beam, wherein said focusing focuses said polarized sample beam such that a beam having a multitude of polarization states is focused onto the sample, wherein said polarization states are functions of an angle φ to a reference plane normal to a sample surface, said angle φ having a range defining a substantial angle of an illumination aperture.

a1 Cont

140 ~~228~~. The method of claim 139 ~~227~~, wherein said focusing focuses said polarized sample beam along different planes of incidence onto the sample, said planes being at different angles φ to the reference plane, the range of said angle of the illumination aperture being about 90 or 180 degrees.

LAW OFFICES OF
SKJERVEN MORRILL LLP
3 EMBARCADERO CENTER
SUITE 2800
SAN FRANCISCO, CA 94111
(415) 217-6000
FAX (415) 434-0646

46

a

141 ~~229~~. The method of claim 139 ~~218~~, the radiation in said sample beam comprising at least one ultraviolet or deep ultraviolet wavelength.

142 ~~230~~. The method of claim 130 ~~218~~, further comprising:

providing a reference beam;

detecting the reference beam to provide a reference spectrum; and

wherein said deriving comprises comparing said spectrum and said reference spectrum to obtain said information of the sample.

143 ~~231~~. An apparatus for measuring optically detectable properties of a sample, comprising:

optics focusing a sample beam of radiation onto the sample, the radiation in said beam comprising at least one ultraviolet or deep ultraviolet wavelength;

a collector collecting radiation modified by the sample; and

a device dispersing the radiation modified by and collected from the sample to provide a spectrum, wherein no substantial relative change in polarization state between the radiation and the sample beam is caused by relative motion between optical elements employed in the focusing and collecting, wherein the radiation in the sample beam and/or the dispersed radiation is polarized;

wherein information on optically detectable properties of the sample is derivable from said spectrum.

91 Cont

LAW OFFICES OF
SKJERVEN MORRILL LLP
3 EMBARCADERO CENTER
SUITE 2800
SAN FRANCISCO, CA 94111
(415) 217-6000
FAX (415) 434-0646

144 ~~232~~. The apparatus of claim 143 ~~231~~, further comprising:

a

a source providing a reference beam; and

a detector detecting the reference beam to provide a reference spectrum;

wherein said information on optically detectable properties of the sample is derivable by a comparison of said spectrum and said reference spectrum.

145 ~~233~~. The apparatus of claim 143 ~~231~~, wherein the radiation in the sample beam and/or the dispersed radiation is polarized.

146 ~~234~~. The apparatus of claim 143 ~~231~~, further comprising a common polarizing element polarizing the sample beam before it reaches the sample, and analyzing the radiation modified by and collected from the sample.

147 ~~235~~. The apparatus of claim 143 ~~231~~, wherein said polarizing and analyzing are performed by means of a polarizer or a polarizing beam splitter.

148 ~~236~~. The apparatus of claim 143 ~~231~~, further comprising a polarizing element polarizing a beam of broadband radiation to provide said sample beam, wherein said focusing focuses said polarized sample beam such that a beam having a multitude of polarization states is focused onto the sample, wherein said polarization states are functions of an angle φ to a reference plane normal to a sample surface, said angle φ having a range defining a substantial angle of an illumination aperture.

a) Cont

149 ~~237~~. The apparatus of claim 148 ~~236~~, wherein said optics focuses said polarized beam along different planes of incidence onto the sample, said planes being at different angles φ to the reference plane, the range of said angle of the illumination aperture being about 90 or 180 degrees.

LAW OFFICES OF
SKJERVEN MORRILL LLP
3 EMBARCADERO CENTER
SUITE 2800
SAN FRANCISCO, CA 94111
(415) 217-6000
FAX (415) 434-0646

a

143

158 ~~238~~. The apparatus of claim ~~231~~ further comprising at least two apertures, said sample having different optically detectable properties along at least two axes, wherein said focusing or collecting are repeated employing at least two different apertures each aligned or centered respectively about one of said axes.

151 150

~~239~~. The apparatus of claim ~~238~~, wherein said at least two different apertures are substantially 90 degrees apart.

152 143

~~240~~. The apparatus of claim ~~231~~, wherein said focusing, collecting and dispersing are performed twice, once with polarization states of the sample beam and/or those of the modified and collected radiation within a first range of angles to a reference plane normal to a sample surface, and another time with said polarization states within a second different range of angles to the reference plane.

153 143

~~241~~. The apparatus of claim ~~231~~, further comprising a polarizing element polarizing the sample beam before it reaches the sample, and/or analyzing the radiation modified by and collected from the sample to polarize the sample beam and/or the modified and collected radiation, and an instrument moving the element between at least two different positions where the focusing, collecting and dispersing are performed.

a1 cont

154 153

~~242~~. The apparatus of claim ~~241~~, wherein said two different positions are substantially 90 degrees apart by rotation.

155 143

~~243~~. The apparatus of claim ~~231~~, further comprising a xenon and/or deuterium lamp supplying radiation for the sample beam.

156

~~244~~. An apparatus for measuring optically detectable properties of a sample, comprising:

LAW OFFICES OF
SKJERVEN MORRILL LLP
3 EMBARCADERO CENTER
SUITE 2800
SAN FRANCISCO, CA 94111
(415) 217-6000
FAX (415) 434-0646

a

optics focusing a sample beam of radiation onto the sample;

a collector collecting radiation modified by the sample;

a device dispersing the radiation modified by and collected from the sample to provide a spectrum, wherein no substantial relative change in polarization state between the radiation and the sample beam is caused by relative motion between optical elements employed in the focusing, collecting and analyzing, wherein information on optically detectable properties of the sample is derivable from the spectrum;

a polarizing element polarizing the sample beam before it reaches the sample and/or analyzing the radiation modified by and collected from the sample; and

an instrument moving the element between at least two positions where said focusing, collecting and dispersing are performed, so that polarization states of the sample beam and/or those of the modified and collected radiation have different ranges of angles to a reference plane normal to a sample surface when said element is at said at least two positions.

157 ~~245~~. The apparatus of claim 156 ~~244~~, wherein said two different positions are substantially 90 degrees apart by rotation.

158 ~~246~~. The apparatus of claim 156 ~~244~~, said polarizing element polarizing the sample beam before it reaches the sample, and analyzing the radiation modified by and collected from the sample.

159 ~~247~~. The apparatus of claim 158 ~~246~~, wherein said polarizing element comprises a polarizer or a polarizing beam splitter.

LAW OFFICES OF
SKJERVEN MORRILL LLP
3 EMBARCADERO CENTER
SUITE 2800
SAN FRANCISCO, CA 94111
(415) 217-6000
FAX (415) 434-0646

a

160 ~~248~~. The apparatus of claim 156 ~~244~~, wherein the polarizing element polarizes a beam of broadband radiation to provide said sample beam, wherein said optics focuses said polarized sample beam such that a beam having a multitude of polarization states is focused onto the sample, wherein said polarization states are functions of an angle φ to a reference plane normal to a sample surface, said angle φ having a range defining a substantial angle of an illumination aperture.

161 ~~249~~. The apparatus of claim 160 ~~248~~, wherein said optics focuses said polarized sample beam along different planes of incidence onto the sample, said planes being at different angles φ to the reference plane, the range of said angle of the illumination aperture being about 90 or 180 degrees.

162 ~~250~~. The apparatus of claim 156 ~~244~~, the radiation in said sample beam comprising at least one ultraviolet or deep ultraviolet wavelength.

163 ~~251~~. The apparatus of claim 156 ~~244~~, further comprising:

a source providing a reference beam;

a detector detecting the reference beam to provide a reference spectrum; and

wherein said information is derivable by comparing said spectrum and said reference spectrum.

C1 Cont

164 ~~252~~. The apparatus of claim 156 ~~244~~, said focusing or collecting being performed twice and within two different ranges of angles to a reference plane normal to a sample surface.

165 ~~253~~. The apparatus of claim 164 ~~252~~, further comprising at least two different apertures, said sample having different optically detectable properties along at least two axes, wherein

LAW OFFICES OF
SKJERVEN MORRILL LLP

3 EMBARCADERO CENTER
SUITE 2800
SAN FRANCISCO, CA 94111
(415) 217-6000
FAX (415) 434-0646

said optics focuses or the collector collects radiation through the at least two different apertures each aligned or centered respectively about one of said axes.

166 ~~254.~~ The apparatus of claim 165 ~~253~~, wherein said at least two different apertures are substantially 90 degrees apart.

167 ~~255.~~ An apparatus for measuring optically detectable properties of a sample, comprising:

optics focusing a sample beam of radiation onto the sample;

a collector collecting radiation modified by the sample; and

a device dispersing the radiation modified by and collected from the sample to provide a spectrum, wherein no substantial relative change in polarization state between the radiation and the sample beam is caused by relative motion between optical elements employed in the focusing, collecting and analyzing,

wherein said information is derivable from the spectrum, and wherein said optics focuses radiation or the collector collects radiation at at least two different times within two different ranges of angles to a reference plane normal to a sample surface.

a, cont

168 ~~256.~~ The apparatus of claim 167 ~~255~~, further comprising at least two different apertures, said sample having different optically detectable properties along at least two axes, wherein said optics focuses or the collector collects radiation through the at least two different apertures each aligned or centered respectively about one of said axes.

169 ~~257.~~ The apparatus of claim 168 ~~256~~, wherein said at least two different apertures are substantially 90 degrees apart.

LAW OFFICES OF
SKJERVEN MORRILL LLP
3 EMBARCADERO CENTER
SUITE 2800
SAN FRANCISCO, CA 94111
(415) 217-6000
FAX (415) 434-0646

a

167

170 ~~258~~. The apparatus of claim ~~255~~, further comprising a polarizing element polarizing the sample beam before it reaches the sample and/or analyzing the radiation modified by and collected from the sample.

170

171 ~~259~~. The apparatus of claim ~~258~~, further comprising an instrument moving the element between at least two positions where said focusing, collecting and dispersing are performed, so that polarization states of the sample beam and/or those of the modified and collected radiation have different ranges of angles to a reference plane normal to a sample surface when the element is at said at least two positions.

172 171

~~260~~. The apparatus of claim ~~259~~, wherein said at least two different positions are substantially 90 degrees apart by rotation.

170

173 ~~261~~. The apparatus of claim ~~258~~, said polarizing element polarizing the sample beam before it reaches the sample, and analyzing the radiation modified by and collected from the sample.

174 173

~~262~~. The apparatus of claim ~~261~~, wherein said polarizing element comprises a polarizer or a polarizing beam splitter.

91 cont

175 170

~~263~~. The apparatus of claim ~~258~~, said polarizing element polarizing a beam of broadband radiation to provide said sample beam, wherein said optics focuses said polarized sample beam such that a beam having a multitude of polarization states is focused onto the sample, wherein said polarization states are functions of an angle φ to a reference plane normal to a sample surface, said angle φ having a range defining a substantial angle of an illumination aperture.

LAW OFFICES OF
SKJERVEN MORRILL LLP
3 EMBARCADERO CENTER
SUITE 2800
SAN FRANCISCO, CA 94111
(415) 217-6000
FAX (415) 434-0646

a

175

176 ~~264~~. The apparatus of claim ~~263~~ 175, wherein said optics focuses said polarized sample beam along different planes of incidence onto the sample, said planes being at different angles φ to the reference plane, the range of said angle of the illumination aperture being about 90 or 180 degrees.

162

177 ~~265~~. The apparatus of claim ~~255~~ 162, the radiation in said sample beam comprising at least one ultraviolet or deep ultraviolet wavelength.

162

178 ~~266~~. The apparatus of claim ~~255~~ 162, further comprising:

a source providing a reference beam; and

a detector detecting the reference beam to provide a reference spectrum;

wherein information on optically detectable properties of the sample is derivable from said spectrum and said reference spectrum.

179 162

~~267~~. The apparatus of claim ~~255~~ 162, further comprising a xenon and/or deuterium lamp supplying radiation for the sample beam.

G) Cont

180 ~~268~~. A method for obtaining information of one or more layers of a sample, said method comprising:

focusing a first sample beam onto the one or more layers, the radiation in said beam comprising at least one ultraviolet or deep ultraviolet wavelength;

collecting radiation that originates from the first beam and that is modified by the one or more layers of the sample;

dispersing the radiation modified and collected from the sample to provide a spectrum;

LAW OFFICES OF
SKJERVEN MORRILL LLP
3 EMBARCADERO CENTER
SUITE 2800
SAN FRANCISCO, CA 94111
(415) 217-6000
FAX (415) 434-0646

focusing a polarized second beam of radiation at said one or more layers in a direction at an oblique angle to the one or more layers;

obtaining measurements of changes in polarization state in amplitude and phase of the radiation that has been modified by the one or more layers and that originates from the second beam; and

deriving information on optically detectable properties of said one or more layers from said measurements and the spectrum.

181 ~~269~~. The method of claim 180 ~~268~~, further comprising:

providing a reference beam; and

detecting the reference beam to provide a reference spectrum;

wherein said information is derivable by comparing said spectrum and said reference spectrum.

182 ~~270~~. The method of claim 180 ~~268~~, further comprising polarizing the first sample beam before it reaches the sample, and analyzing the radiation modified by and collected from the sample, by a common polarizing element.

183 ~~271~~. The method of claim 182 ~~270~~, wherein said polarizing and analyzing are performed by means of a polarizer or a polarizing beam splitter.

184 ~~272~~. The method of claim 180 ~~268~~, further comprising polarizing a beam of broadband radiation to provide said first sample beam, wherein said first sample beam focusing focuses said polarized first sample beam such that a beam having a multitude of polarization states is focused onto the sample, wherein said polarization states are functions of an angle φ to a

9)
Sent

LAW OFFICES OF
SKJERVEN MORRILL LLP
3 EMBARCADERO CENTER
SUITE 2800
SAN FRANCISCO, CA 94111
(415) 217-6000
FAX (415) 434-0646

551

a

reference plane normal to a sample surface, said angle φ having a range defining a substantial angle of an illumination aperture.

185 ~~273.~~ The method of claim 184 ~~272,~~ wherein said first sample beam focusing focuses said polarized beam along different planes of incidence onto the sample, said planes being at different angles φ to the reference plane, the range of said angle of the illumination aperture being about 90 or 180 degrees.

186 ~~274.~~ The method of claim 180 ~~268,~~ said first sample beam focusing or collecting being performed at least twice and within at least two different ranges of angles to a reference plane normal to a sample surface.

187 ~~275.~~ The method of claim 181 ~~269,~~ said sample having different optically detectable properties along at least two axes, wherein said first sample beam focusing or collecting are repeated employing at least two different apertures each aligned or centered respectively about one of said axes.

188 ~~276.~~ The method of claim 187 ~~275,~~ wherein said at least two different apertures are substantially 90 degrees apart.

91 Cont

189 ~~277.~~ The method of claim 180 ~~268,~~ wherein said first sample beam focusing, collecting, dispersing and deriving are performed twice, once with polarization states of the first sample beam and/or those of the modified and collected radiation within a first range of angles to a reference plane normal to a sample surface, and another time with said polarization states within a second different range of angles to the reference plane.

LAW OFFICES OF
SKJERVEN MORRILL LLP
3 EMBARCADERO CENTER
SUITE 2800
SAN FRANCISCO, CA 94111
(415) 217-6000
FAX (415) 434-0646

190 ~~278.~~ The method of claim 189 ~~277,~~ further comprising polarizing the first sample beam before it reaches the sample, and/or analyzing the radiation modified by and collected from

the sample with a polarizing element so that radiation of the first sample beam and/or the modified and collected radiation is polarized, with the polarizing element in two different positions when the focusing, collecting, dispersing and deriving are performed twice.

191 ~~279~~. The method of claim 190 ~~278~~, wherein said two different positions are substantially 90 degrees apart by rotation.

192 ~~280~~. A method for obtaining information of one or more layers of a sample, said method comprising:

focusing a first sample beam of radiation onto the one or more layers;

collecting radiation that originates from the first beam and that is modified by the one or more layers of the sample;

dispersing the radiation modified and collected from the sample to provide a spectrum;

focusing a polarized second beam of radiation at said one or more layers in a direction at an oblique angle to the one or more layers;

obtaining measurements of changes in polarization state in amplitude and phase of the radiation that has been modified by the one or more layers and that originates from the second beam;

91 Cont

deriving information on optically detectable properties of said one or more layers from said measurements and the spectrum; and

LAW OFFICES OF
SKJERVEN MORRILL LLP
3 EMBARCADERO CENTER
SUITE 2800
SAN FRANCISCO, CA 94111
(415) 217-6000
FAX (415) 434-0646

polarizing the first sample beam before it reaches the sample and/or analyzing the radiation modified by and collected from the sample, wherein said first sample beam focusing, collecting, dispersing and deriving are performed twice, once with polarization

57 a

states of the first sample beam and/or those of the modified and collected radiation within a first range of angles to a reference plane normal to a sample surface, and another time with said polarization states within a second different range of angles to the reference plane.

193 ~~281~~. The method of claim ~~280~~ 192, wherein said polarizing is performed with a polarizing element so that radiation of the first sample beam and/or the modified and collected radiation is polarized, with the polarizing element in two different positions when the focusing, collecting dispersing, deriving and polarizing are performed twice.

194 ~~282~~. The method of claim ~~281~~ 193, wherein said two different positions are substantially 90 degrees apart by rotation.

195 ~~283~~. The method of claim ~~281~~ 193, further comprising polarizing the first sample beam before it reaches the sample, and analyzing the radiation modified by and collected from the sample, by a common polarizing element.

196 ~~284~~. The method of claim ~~283~~ 195, wherein said polarizing and analyzing are performed by means of a polarizer or a polarizing beam splitter.

a) Cont

197 ~~285~~. The method of claim ~~280~~ 192, wherein the polarizing polarizes a beam of broadband radiation to provide said first sample beam, wherein said first sample beam focusing focuses said polarized first sample beam such that a beam having a multitude of polarization states is focused onto the sample, wherein said polarization states are functions of an angle φ to a reference plane normal to a sample surface, said angle φ having a range defining a substantial angle of an illumination aperture.

198 ~~286~~. The method of claim ~~285~~ 197, wherein said first sample beam focusing focuses said polarized first sample beam along different planes of incidence onto the sample, said planes

LAW OFFICES OF
SKJERVEN MORRILL LLP
3 EMBARCADERO CENTER
SUITE 2800
SAN FRANCISCO, CA 94111
(415) 217-6000
FAX (415) 434-0646

being at different angles φ to the reference plane, the range of said angle of the illumination aperture being about 90 or 180 degrees.

199 ~~287~~. The method of claim ~~280~~ 192, the radiation in said first sample beam comprising at least one ultraviolet or deep ultraviolet wavelength.

200 ~~288~~. The method of claim ~~280~~ 192, further comprising:

providing a reference beam;

detecting the reference beam to provide a reference spectrum; and

wherein said deriving comprises comparing said spectrum and said reference spectrum.

201 ~~289~~. The method of claim ~~280~~ 192, said first sample beam focusing or collecting being performed twice and within two different ranges of angles to a reference plane normal to a sample surface.

202 ~~290~~. The method of claim ~~289~~ 201, said sample having different optically detectable properties along at least two axes, wherein said first sample beam focusing or collecting are performed twice employing at least two different apertures each aligned or centered respectively about one of said axes.

203 ~~291~~. The method of claim ~~290~~ 202, wherein said at least two different apertures are substantially 90 degrees apart.

264 ~~292~~. A method for obtaining information of one or more layers of a sample, said method comprising:

focusing a first sample beam of radiation onto the one or more layers;

G1) Cont

LAW OFFICES OF
SKJERVEN MORRILL LLP
3 EMBARCADERO CENTER
SUITE 2800
SAN FRANCISCO, CA 94111
(415) 217-6000
FAX (415) 434-0646

59

a

collecting radiation that originates from the first beam and that is modified by the one or more layers of the sample;

dispersing the radiation modified and collected from the sample to provide a spectrum;

focusing a polarized second beam of radiation at said one or more layers in a direction at an oblique angle to the one or more layers;

obtaining measurements of changes in polarization state in amplitude and phase of the radiation that has been modified by the one or more layers and that originates from the second beam; and

deriving information on optically detectable properties of said one or more layers from said measurements and the spectrum;

said first sample beam focusing or collecting being performed twice and within two different ranges of angles to a reference plane normal to a sample surface.

205 ~~293.~~ The method of claim ~~292~~ 204, said sample having different optically detectable properties along at least two axes, wherein said first sample beam focusing or collecting are performed twice employing at least two different apertures each aligned or centered respectively about one of said axes.

91 Cont

206 ~~294.~~ The method of claim ~~293~~ 205, wherein said at least two different apertures are substantially 90 degrees apart.

207 ~~295.~~ The method of claim ~~292~~ 204, further comprising polarizing the first sample beam before it reaches the sample and/or analyzing the radiation modified by and collected from the sample, wherein said first sample beam focusing, collecting and dispersing are performed

LAW OFFICES OF
SKJERVEN MORRILL LLP
3 EMBARCADERO CENTER
SUITE 2800
SAN FRANCISCO, CA 94111
(415) 217-6000
FAX (415) 434-0646

60

a

twice, once with polarization states of the first sample beam and/or those of the modified and collected radiation within a first range of angles to a reference plane normal to a sample surface, and another time with said polarization states within a second different range of angles to the reference plane.

208 ~~296.~~ The method of claim 207 ~~295,~~ wherein said polarizing is performed with a polarizing element so that radiation of the first sample beam and/or the modified and collected radiation is polarized, with the polarizing element in two different positions when the first sample beam focusing, collecting and dispersing are performed twice.

209 ~~297.~~ The method of claim 208 ~~296,~~ wherein said two different positions are substantially 90 degrees apart by rotation.

210 ~~298.~~ The method of claim 208 ~~296,~~ further comprising polarizing the first sample beam before it reaches the sample, and analyzing the radiation modified by and collected from the sample, by a common polarizing element.

211 ~~299.~~ The method of claim 210 ~~298~~, wherein said polarizing and analyzing are performed by means of a polarizer or a polarizing beam splitter.

91 Cont

212 ~~300.~~ The method of claim 204 ~~292,~~ further comprising polarizing a beam of broadband radiation to provide said first sample beam, wherein said first sample beam focusing focuses said polarized first sample beam such that a beam having a multitude of polarization states is focused onto the sample, wherein said polarization states are functions of an angle φ to a reference plane normal to a sample surface, said angle φ having a range defining a substantial angle of an illumination aperture.

LAW OFFICES OF
SKJERVEN MORRILL LLP
3 EMBARCADERO CENTER
SUITE 2800
SAN FRANCISCO, CA 94111
(415) 217-6000
FAX (415) 434-0646

213 ~~301~~. The method of claim ~~300~~ 212, wherein said first sample beam focusing focuses said polarized first sample beam along different planes of incidence onto the sample, said planes being at different angles φ to the reference plane, the range of said angle of the illumination aperture being about 90 or 180 degrees.

214 ~~302~~. The method of claim ~~292~~ 204, the radiation in said first sample beam comprising at least one ultraviolet or deep ultraviolet wavelength.

215 ~~303~~. The method of claim ~~292~~ 204, further comprising:

providing a reference beam;

detecting the reference beam to provide a reference spectrum; and

wherein said deriving comprises comparing said spectrum and said reference spectrum to obtain said information of the sample.

216 ~~304~~. An apparatus for obtaining information of one or more layers of a sample, said apparatus comprising:

optics focusing a first sample beam of radiation to the one or more layers, and a second sample beam of polarized radiation at said one or more layers in a direction at an oblique angle to the one or more layers, the radiation in said first beam comprising at least one ultraviolet or deep ultraviolet wavelength;

4, Cont

a collector collecting radiation that originates from the first beam and that is modified by the one or more layers of the sample;

LAW OFFICES OF
SKJERVEN MORRILL LLP
3 EMBARCADERO CENTER
SUITE 2800
SAN FRANCISCO, CA 94111
(415) 217-6000
FAX (415) 434-0646

a device dispersing the radiation modified and collected from the sample to provide a spectrum; and

an ellipsometer obtaining measurements of changes in polarization state in amplitude and phase of the modified radiation from the one or more layers originating from second beam;

wherein said information on optically detectable properties of said one or more layers is derivable from the measurements of the ellipsometer and the spectrum.

217 ~~305.~~ The apparatus of claim ~~304~~ 216, further comprising:

a source providing a reference beam;

a detector detecting the reference beam to provide a reference spectrum; and

wherein said information is derivable by a comparison of said spectrum and said reference spectrum.

218 ~~306.~~ The apparatus of claim ~~304~~ 216, further comprising a common polarizing element polarizing the first sample beam before it reaches the sample, and analyzing the radiation modified by and collected from the sample.

219 ~~307.~~ The apparatus of claim ~~306~~ 218, wherein said polarizing and analyzing are performed by means of a polarizer or a polarizing beam splitter.

9, cont

220 ~~308.~~ The apparatus of claim ~~304~~ 216, further comprising a polarizing element polarizing a beam of broadband radiation to provide said first sample beam, wherein said optics focuses said polarized first sample beam such that a beam having a multitude of polarization states is focused onto the sample, wherein said polarization states are functions of an angle φ to a reference plane normal to a sample surface, said angle φ having a range defining a substantial angle of an illumination aperture.

LAW OFFICES OF
SKJERVEN MORRILL LLP
3 EMBARCADERO CENTER
SUITE 2800
SAN FRANCISCO, CA 94111
(415) 217-6000
FAX (415) 434-0646

221 ~~309.~~ The apparatus of claim ~~308,~~ 220 wherein said optics focuses said polarized first sample beam along different planes of incidence onto the sample, said planes being at different angles φ to the reference plane, the range of said angle of the illumination aperture being about 90 or 180 degrees.

222 ~~310.~~ The apparatus of claim ~~304,~~ 216 further comprising at least two apertures, said sample having different optically detectable properties along at least two axes, wherein said first sample beam focusing or collecting are repeated employing at least two different apertures each aligned or centered respectively about one of said axes.

223 ~~311.~~ The apparatus of claim ~~310,~~ 222 wherein said at least two different apertures are substantially 90 degrees apart.

224 ~~312.~~ The apparatus of claim ~~304,~~ 216 wherein said first sample beam focusing, collecting, dispersing and deriving are performed twice, once with polarization states of the first sample beam and/or those of the modified and collected radiation within a first range of angles to a reference plane normal to a sample surface, and another time with said polarization states within a second different range of angles to the reference plane.

225 ~~313.~~ The apparatus of claim ~~304,~~ 216 further comprising a polarizing element polarizing the first sample beam before it reaches the sample, and/or analyzing the radiation modified by and collected from the sample to polarize the first sample beam and/or the modified and collected radiation, and an instrument moving the element between at least two different positions where the focusing, collecting and dispersing are performed.

91 Cong

226 ~~314.~~ The apparatus of claim ~~313,~~ 225 wherein said two different positions are substantially 90 degrees apart by rotation.

LAW OFFICES OF
SKJERVEN MORRILL LLP
3 EMBARCADERO CENTER
SUITE 2800
SAN FRANCISCO, CA 94111
(415) 217-6000
FAX (415) 434-0646

227 ~~315~~. An apparatus for obtaining information of one or more layers of a sample, said apparatus comprising:

optics focusing a first sample beam of radiation to the one or more layers, and a second sample beam of polarized radiation at said one or more layers in a direction at an oblique angle to the one or more layers, the radiation in said first beam comprising at least one ultraviolet or deep ultraviolet wavelength;

a collector collecting radiation that originates from the first beam and that is modified by the one or more layers of the sample;

a device dispersing the radiation modified and collected from the sample to provide a spectrum;

a polarizing element polarizing the first sample beam before it reaches the sample and/or analyzing the radiation modified by and collected from the sample before such radiation is dispersed by the device;

an ellipsometer obtaining measurements of changes in polarization state in amplitude and phase of the modified radiation from the one or more layers originating from second beam;

wherein said information on optically detectable properties of said one or more layers is derivable from measurements of the ellipsometer and the spectrum; and

an instrument moving the element between at least two positions, so that polarization states of the first sample beam and/or those of the modified and collected radiation have different ranges of angles to a reference plane normal to a sample surface when said element is at said at least two positions.

9, Smx

LAW OFFICES OF
SKJERVEN MORRILL LLP
3 EMBARCADERO CENTER
SUITE 2800
SAN FRANCISCO, CA 94111
(415) 217-6000
FAX (415) 434-0646

65

a

228 ~~316~~. The apparatus of claim ~~315~~ 227 wherein said two different positions are substantially 90 degrees apart by rotation.

229 ~~317~~. The apparatus of claim ~~315~~ 227, said polarizing element polarizing the first sample beam before it reaches the sample, and analyzing the radiation modified by and collected from the sample.

230 ~~318~~. The apparatus of claim ~~315~~ 227, wherein said polarizing element comprises a polarizer or a polarizing beam splitter.

231 ~~319~~. The apparatus of claim ~~315~~ 227, wherein the polarizing element polarizes a beam of broadband radiation to provide said first sample beam, wherein said optics focuses said polarized first sample beam such that a beam having a multitude of polarization states is focused onto the sample, wherein said polarization states are functions of an angle φ to a reference plane normal to a sample surface, said angle φ having a range defining a substantial angle of an illumination aperture.

232 ~~320~~. The apparatus of claim ~~319~~ 231, wherein said optics focuses said polarized first sample beam along different planes of incidence onto the sample, said planes being at different angles φ to the reference plane, the range of said angle of the illumination aperture being about 90 or 180 degrees.

233 ~~321~~. The apparatus of claim ~~315~~ 227, the radiation in said first sample beam comprising at least one ultraviolet or deep ultraviolet wavelength.

234 ~~322~~. The apparatus of claim ~~315~~ 227, further comprising:

a source providing a reference beam;

41 Cont

LAW OFFICES OF
SKJERVEN MORRILL LLP
3 EMBARCADERO CENTER
SUITE 2800
SAN FRANCISCO, CA 94111
(415) 217-6000
FAX (415) 434-0646

06

a

a detector detecting the reference beam to provide a reference spectrum; and

wherein information on optically detectable properties of the sample by a comparison of said spectrum and said reference spectrum.

235 ~~323~~. The apparatus of claim 227 ~~315~~, said focusing or collecting being performed twice and within two different ranges of angles to a reference plane normal to a sample surface.

236 ~~324~~. The apparatus of claim 235 ~~323~~, further comprising at least two different apertures, said sample having different optically detectable properties along at least two axes, wherein said optics focuses or the collector collects radiation through the at least two different apertures each aligned or centered respectively about one of said axes.

237 ~~325~~. The apparatus of claim 236 ~~324~~, wherein said at least two different apertures are substantially 90 degrees apart.

238 ~~326~~. An apparatus for obtaining information of one or more layers of a sample, said apparatus comprising:

9, cont

optics focusing a first sample beam of radiation to the one or more layers, and a second sample beam of polarized radiation at said one or more layers in a direction at an oblique angle to the one or more layers, the radiation in said first beam comprising at least one ultraviolet or deep ultraviolet wavelength;

a collector collecting radiation that originates from the first beam and that is modified by the one or more layers of the sample;

a device analyzing and dispersing the radiation modified and collected from the sample to provide a spectrum; and

LAW OFFICES OF
SKJERVEN MORRILL LLP
3 EMBARCADERO CENTER
SUITE 2800
SAN FRANCISCO, CA 94111
(415) 217-6000
FAX (415) 434-0646

an ellipsometer obtaining measurements of changes in polarization state in amplitude and phase of the modified radiation from the one or more layers originating from second beam;

wherein said information on optically detectable properties of said one or more layers from the measurements of the ellipsometer and the spectrum, and wherein said optics focuses radiation in the first sample beam or the collector collects radiation at at least two different times within two different ranges of angles to a reference plane normal to a sample surface.

239 ~~327.~~ The apparatus of claim 338 ~~326,~~ further comprising at least two different apertures, said sample having different optically detectable properties along at least two axes, wherein said optics focuses or the collector collects radiation from the first sample beam through the at least two different apertures each aligned or centered respectively about one of said axes.

240 ~~328.~~ The apparatus of claim 239 ~~327,~~ wherein said at least two different apertures are substantially 90 degrees apart.

241 ~~329.~~ The apparatus of claim 238 ~~326~~, further comprising a polarizing element polarizing the first sample beam before it reaches the sample and/or analyzing the radiation modified by and collected from the sample, and an instrument moving the element between at least two positions where said first sample beam focusing, collecting and dispersing are performed, so that polarization states of the first sample beam and/or those of the modified and collected radiation have different ranges of angles to a reference plane normal to a sample surface when the element is at said at least two positions.

91 Cong

242 ~~330.~~ The apparatus of claim 241 ~~329,~~ wherein said at least two different positions are substantially 90 degrees apart by rotation.

LAW OFFICES OF
SKJERVEN MORRILL LLP
3 EMBARCADERO CENTER
SUITE 2800
SAN FRANCISCO, CA 94111
(415) 217-6000
FAX (415) 434-0646

a

243 ~~331.~~ The apparatus of claim 241 ~~329~~, said polarizing element polarizing the first sample beam before it reaches the sample, and analyzing the radiation modified by and collected from the sample.

244 ~~332.~~ The apparatus of claim 243 ~~331~~, wherein said polarizing element comprises a polarizer or a polarizing beam splitter.

245 ~~333.~~ The apparatus of claim 244 ~~329~~, said polarizing element polarizing a beam of broadband radiation to provide said first sample beam, wherein said optics focuses said polarized first sample beam such that a beam having a multitude of polarization states is focused onto the sample, wherein said polarization states are functions of an angle φ to a reference plane normal to a sample surface, said angle φ having a range defining a substantial angle of an illumination aperture.

246 ~~334.~~ The apparatus of claim 245 ~~333~~, wherein said optics focuses said polarized first sample beam along different planes of incidence onto the sample, said planes being at different angles φ to the reference plane, the range of said angle of the illumination aperture being about 90 or 180 degrees.

247 ~~335.~~ The apparatus of claim 238 ~~326~~, the radiation in said first sample beam comprising at least one ultraviolet or deep ultraviolet wavelength.

248 ~~336.~~ The apparatus of claim 238 ~~326~~, further comprising:

a source providing a reference beam;

a detector detecting the reference beam to provide a reference spectrum; and

9 / Cons

LAW OFFICES OF
SKJERVEN MORRILL LLP
3 EMBARCADERO CENTER
SUITE 2800
SAN FRANCISCO, CA 94111
(415) 217-6000
FAX (415) 434-0646

a

information on optically detectable properties of the sample is derivable from a comparison of said spectrum and said reference spectrum.

9) Cont

249 ~~337.~~ The apparatus of claim 238 ~~326~~, further comprising a xenon and/or deuterium lamp supplying radiation for the first sample beam.

LAW OFFICES OF
SKJERVEN MORRILL LLP

3 EMBARCADERO CENTER
SUITE 2800
SAN FRANCISCO, CA 94111
(415) 217-6000
FAX (415) 434-0646